

## Differential Reinforcement of Other Behavior Applied Classwide in a Child Care Setting

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### Abstract

This study investigated the effectiveness of implementing Differential Reinforcement of Other behavior (DRO) at the classwide level to decrease the disruptive behavior of seven typically developing preschool-aged children in a child care setting. After baseline data were collected, a whole interval DRO reinforcement schedule using edible rewards was implemented for four weeks. Disruptive behavior decreased after the intervention was implemented. This report adds to the existing research literature supporting the use of DRO in classroom settings (e.g., Conyers et al., 2003; Repp, Barton, & Brulle, 1983) and extends the literature on the use of DRO with typically developing preschoolers. Limitations of this study and future research recommended in this area are discussed.

**Keywords:** preschool age, differential reinforcement (DR), differential reinforcement of other behavior (DRO), disruptive behavior, classwide, day care, child care, and community based

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Differential reinforcement of other behavior (DRO) is a procedure in which reinforcement is delivered dependent on the absence of the target behavior (Conyers, Miltenberger, Romaniuk, Kopp, & Himle, 2003). To implement this technique, data are collected on the occurrence of the target behavior and the average duration between behaviors is determined (i.e., the inter-response interval). This information drives the reinforcement schedule that is delivered if the target behavior does not occur. For example, if data gathered during baseline suggest that the target behavior occurs once every minute, reinforcement will be delivered at the end of a minute if the target behavior has not been exhibited. Once behavioral control has been established, the interval required for delivery of the reinforcement is progressively increased (de Zubicaray & Clair, 1998).

DRO has proven effective in eliminating a wide variety of problem behaviors with different populations, and it is a procedure that does not require extensive training to implement (Homer & Peterson, 1980). Homer and Peterson (1980) reported that DRO schedules of reinforcement produce rapid inhibition of response in applied settings and that no undesirable side effects of the intervention had been reported in the literature. The authors predicted any possible side effects to be positive in nature due to the positive reinforcement aspect of the intervention (Homer & Peterson, 1980).

By definition, DRO must be paired with some type of reinforcement of non-targeted behaviors. Past research has demonstrated that DRO paired with edible reinforcement has reduced inappropriate behaviors in children (e.g., Repp, Dietz, & Dietz, 1976). Specifically, Repp et al. (1976) reported success in reducing levels of inappropriate responding in a classroom using a DRO schedule of reinforcement paired with a token economy. The students exchanged their tokens for games, activities, and refreshments.

The DRO intervention has been implemented in two ways: whole interval DRO (wDRO) and momentary DRO (mDRO). The wDRO procedure involves administering the reinforcer if behavior other than the target behavior (hereafter "other behavior") is exhibited for the entire interval. In contrast, the mDRO procedure involves administering the reinforcer if the other behavior is exhibited at the time of a prompt (e.g., the sound of a timer). One study found that wDRO decreased inappropriate behavior more than mDRO (Repp, Barton, & Brulle, 1983). Repp et al. (1983) conducted two studies to compare the effectiveness of whole interval DRO and momentary DRO. The results indicated that although wDRO was more effective than momentary, the value of mDRO cannot be ignored. In fact, the mDRO schedule

reduced inappropriate behavior (Repp et al., 1983). The authors noted the difficulty of implementing wDRO accurately due to the constant attention required by the observer. Therefore, the suggestion was offered to alternate whole interval and momentary DRO schedules to enhance the effectiveness of a momentary DRO schedule (Repp et al., 1983).

Research has been conducted using the DRO procedure to target aggressive behavior. For example, de Zubicaray and Clair (1998) reported decreases in verbal abuse and physical aggression, and increases in prosocial behaviors in a woman with moderate mental retardation who was living in an institutional setting. This study implemented two differential reinforcement procedures in a multi-component intervention, pairing DRO with restitution and differential reinforcement of incompatible behavior (DRI). In this study, during the DRI component, the participant was reinforced for exhibiting prosocial behaviors taught as part of the intervention. During the DRO component, the participant was reinforced for exhibiting any behavior other than the target behavior. Decreases in verbal abuse and physical aggression were observed in phases of the study that included DRO and DRI components. However, due to the fact that DRO was implemented as part of a multi-component design involving various behavioral techniques, causal conclusions cannot be made regarding the specific effect of the DRO intervention in this study.

Conyers et al. (2004) used an alternating treatments design to evaluate the effectiveness of DRO and response cost in a preschool classroom setting. Response cost and DRO sessions occurred on alternating days and disruptive behavior was observed at the classwide level. As expected, the researchers found that the response cost component resulted in more drastic and lasting reductions of disruptive behavior compared to the DRO component. Still, the DRO component was an effective approach to decreasing disruptive behavior throughout the study.

Conyers et al. (2003) also reported success in implementing DRO at the classwide level with preschoolers exhibiting disruptive behaviors. This study reported a decrease in the frequency of disruptive behaviors exhibited by students. Also, the number of children who engaged in disruptive behavior decreased after the DRO intervention was implemented. The researchers used a reversal design with multiple treatment conditions to measure the effectiveness of momentary DRO [mDRO] and whole DRO [wDRO] with various reinforcers. Conyers et al. (2003) reported that wDRO with edible reinforcement produced the greatest decreases in disruptive behavior. The authors also reported that mDRO produced modest results when paired with tangible reinforcers.

The present case study intended to extend the work of de Zubicaray and Clair (1998) by isolating DRO as the intervention to assess its effectiveness. The high rates of reinforcement and lengthening of intervals referred to by Homer and Peterson (1980) provided a basis for this study. Additionally, this project attempted to expand the research of Repp et al. (1983), which confirmed that inappropriate behavior is reduced using momentary DRO. Also, this study expanded on the findings of Conyers et al. (2003) by examining the effectiveness of momentary DRO with edible reinforcement. This study implemented a momentary DRO reinforcement schedule using edible reinforcement.

It is important to note that the following case study was not initially implemented as a research project. Rather, the first author of the manuscript was a consultant in the child care program working to implement evidence-based behavioral interventions. Therefore, because of its applied nature, some limitations emerged that could not be corrected. Still, we feel this case study makes a valuable contribution to the literature.

## **Method**

### *Participants and Setting*

Seven Caucasian preschool children enrolled in a community-based child care program served as subjects of this study. Five participants were boys and two participants were girls. The children were typically developing and did not have an identified disability. Their ages ranged from 2 years 6 months to 3 years 6 months, and they spent about seven hours per day in the child care setting. Classroom activities varied among free play, art, lunch/snack, nap, gross motor, and circle time. Although one student exhibited the majority of the disruptive behavior, the intervention was implemented at the classwide level.

### Measures

*Data collection system.* Disruptive behavior was identified as the target behavior in consultation with the classroom teacher. *Disruptive behavior* was defined as touching a peer or teacher with hands, fingers, arms, or feet. Disruptive behavior included poking, tackling, hitting, or kicking the teacher or peers.

Data collection began at the onset of circle time and continued for the length of that activity. During baseline, the teacher tallied instances of disruptive behavior during circle time on paper. During intervention, the teacher set aside an M&M after observing each instance of disruptive behavior, calculating a total at the end of circle time. Thus, the M&Ms set aside served as the method of data collection. One follow-up data point was collected 46 days after termination of the intervention.

A second teacher recorded disruptive behavior during circle time every ninth day, resulting in two days of interobserver data collection. Interobserver agreement (IOA) was calculated by dividing the smaller number of recorded responses by the larger number and multiplying by 100. The interobserver agreement was 58%, which is lower than the acceptable range. This issue is addressed further in the discussion section.

*Treatment acceptability.* Teacher acceptability of the intervention was measured using the Behavioral Intervention Rating Scale (BIRS; Von Brock & Elliot, 1987). The BIRS consists of 24 self-report items rated on a 6-point Likert scale (1= Strongly disagree; 6= Strongly agree). Higher mean level scores indicate higher acceptability. Teacher acceptability ranged from 5.9 to 6, which is in the highly acceptable range.

*Treatment integrity.* A 6-item treatment integrity checklist was developed for this study to provide an index of teacher adherence to the DRO intervention. Table 1 presents this checklist. The principal author of this study evaluated the teacher's performance using the checklist every fourth day of intervention, resulting in five days of data. Treatment integrity scores ranged from 50-100% ( $M = 66\%$ ), which is low, yet adequate.

Table 1

#### Teacher Treatment Integrity Checklist

YES	NO	NO OPP	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sets the timer for ___ minute(s)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hands out M&M when timer beeps
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Gives labeled praise with M&M
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ignores inappropriate behavior
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Keeps M&M for inappropriate behavior
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tallies inappropriate behaviors on data sheet after circle time

*Sutter-Eyberg Student Behavior Inventory – Revised (SESBI-R).* The SESBI-R is a teacher-rating scale of conduct problems that may be exhibited by children ages 2 through 16 in the school setting

(Eyberg & Pincus, 1999). The measure is composed of 38 items. Teachers endorse a frequency score (1=Never to 7=Always) and report whether they perceive the behavior to be a problem. The SESBI-R yields two scores: an Intensity score (based on the frequency of behavior problems) and a Problem score (based on the number of items endorsed as problematic). Eyberg and Pincus (1999) have suggested an Intensity score of 151 and a Problem score of 19 as cutoffs to estimate the severity of child behavior problems at school. The classroom teacher completed a SESBI-R for each student before and after the intervention was implemented. Pre-intervention and post-intervention average intensity scores were 79 and 64 (respectively), while pre-intervention and post-intervention problem scores were 3.86 and 3.14 (respectively). These scores are lower than the clinical cutoff score.

### *Procedure*

Before the study began, information was gathered from the teacher on the students' preference for reinforcement. This resulted in the use of small pieces of chocolate (i.e., M&Ms) as primary reinforcers. The teacher was instructed to deliver M&Ms along with labeled praise (i.e., praising a specific behavior) to any student who was not exhibiting the target behavior.

*Design.* Due to the applied nature of the project, an A-B design was used for this intervention. Five days of baseline were followed by 18 days of intervention.

*Baseline.* Baseline data were collected for five days. The classroom teacher was responsible for recording the duration of circle time and tallying the amount of disruptive behaviors observed during circle time. The number of disruptive behaviors exhibited by all students during circle time was divided by the duration of circle time in order to provide a measure of the rate of the target behavior. The teacher was instructed to conduct circle time as usual.

*Intervention: Differential Reinforcement of Other behavior (DRO).* During the intervention phase, the teacher was instructed to set the timer to the appropriate interval and conduct circle time. Initially, the DRO interval was set at one minute. After ten days of intervention, the interval was changed to five minutes because student behavior improved. Increases in interval duration were made throughout the intervention phase to reflect the amount of disruptive behavior observed. The final DRO interval was set at 10 minutes.

*Delivery of reinforcement during DRO.* When the timer beeped, the teacher delivered an M&M to randomly selected students for not exhibiting disruptive behavior. As the teacher delivered M&Ms to individual students, she was instructed to provide labeled praise to individual students for exhibiting appropriate behavior during circle time. For example, "nice job sitting like a pretzel" or "thank you for keeping your hands to yourself". During each occurrence of disruptive behavior, the timer was reset, the behavior was ignored, no reinforcement was delivered, and the teacher set aside an M&M. The M&Ms set aside by the teacher were added at the end of circle time and tallied on the data sheet as the total number of disruptive behaviors for that day.

## **Results**

Figure 1 shows the number of negative behaviors observed by the teacher. The baseline data consisted of 5 data points varying between 0 and 1 occurrence per minute, with a mean of 0.63 negative responses per minute (rpm). These data were variable (i.e., data that shows shifts of 50% or more away from the mean). The baseline data showed an ascending trend, which illustrated an increase of negative behavior prior to intervention. Negative behaviors during the treatment phase (i.e., 18 data points) varied between 0 and 0.5, with a mean of 0.12 negative responses per minute (rpm). These data were also found to be variable and represented a descending trend. A descending trend was a positive finding because the challenging behavior was occurring less frequently. Therefore, the introduction of the DRO intervention

reduced mean levels from 0.63 rpm to 0.12 rpm. Between phases there were 2 points that overlapped which represented 20% of the data. This was a positive finding because less than 50% of the data overlapped and were, therefore, stable. At follow-up, zero instances of disruptive behavior were observed.

#### *Treatment Acceptability, Treatment Integrity, and Interobserver Agreement*

Treatment acceptability ratings obtained by teachers at the end of the intervention were in the highly acceptable range. One teacher's mean BIRS rating was 5.9 and the second teacher reported a mean rating of 6. Six was the highest possible mean rating that could be obtained on the BIRS. The mean teacher treatment integrity for the DRO intervention ranged from 50-100% ( $M = 66\%$ ). Although not ideal, this was considered adequate treatment fidelity for the purposes of this project. Interobserver agreement was 58%, which is lower than the acceptable range.

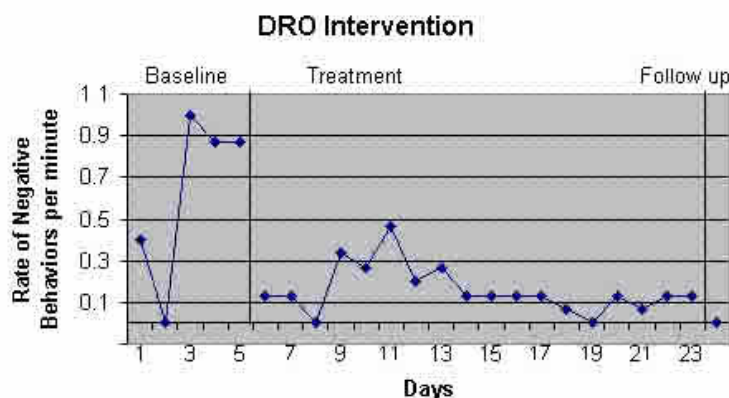


Figure 1. Rate of negative behaviors per minute exhibited during circle time.

#### *Findings on the SESBI-R*

On average, the Intensity score on the SESBI-R obtained before and after the intervention was below the cutoff score suggestive of severe child behavior problems at school (Pre-intervention  $M=79$ ,  $SD=46$ ; Post-intervention  $M=64$ ,  $SD=55$ ). However, the teacher clearly found the behavior challenging. A paired samples t-test was performed to compare scores before and after the intervention. Intensity scores on the SESBI-R were significantly lower after the intervention was implemented,  $t(1,6) = 2.71$ ,  $p < .05$ .

A similar result was observed with the SESBI-R Problem scores, which were lower than the suggested clinical cutoff score (Pre-intervention  $M=3.86$ ;  $SD=8.03$ ; Post-intervention  $M=3.14$ ,  $SD=7.47$ ). Still, a paired samples t-test revealed there were significantly lower Problem scores after the intervention,  $t(1,6) = 2.5$ ,  $p < .05$ . The results observed for both the Intensity and Problem scores over time are another indication of improved classwide behavior after the DRO intervention was implemented.

### **Discussion**

This study was conducted to evaluate the effectiveness of DRO intervention in a preschool classroom during circle time. Overall, the results of this study demonstrate that DRO was an effective intervention to reduce disruptive behavior of typically developing preschool-age students during circle time. Negative behaviors were reduced from an average of 0.63 occurrences per minute during baseline to 0.12 occurrences during intervention. These results are consistent with the findings of Conyers et al. (2003) who reported a decrease in disruptive behaviors using DRO at the classwide level with preschoolers exhibiting disruptive behaviors.



There are several limitations to be noted in this study. First, although an A-B design is easiest for teachers to implement, it is not considered a true experimental design. In this project, an A-B design was chosen due to the applied nature of the consultation and in an effort to maximize teacher acceptability of the DRO intervention.

To improve on this limitation, future research involving preschool children and DRO to decrease negative behaviors should use an ABAB or multiple baseline design. Second, according to the literature, DRO rates of reinforcement are meant to be modified daily to represent that day's data. In this study, the rate of reinforcement was changed weekly because the consultant visited the child care setting on a weekly basis. Future research may focus on modifying the rate of reinforcement every day to respond to daily changes in student behavior.

A third limitation of this project lies in the interobserver agreement. The agreement between the two teachers (i.e., the number of behaviors observed during circle time) was low at 58%. Therefore, one cannot be certain that the number of behaviors reported by the original teacher were accurate. This may be attributed to observer drift (Kazdin, 1977), which occurs when the observer does not consistently apply the behavioral definition over time. This limitation can be addressed in future research by providing feedback along the way focusing on the target behavior definition. Also, interobserver agreement may have been low because extensive coding practice did not take place before data were collected.

Although the intervention was successful, one cannot conclude a causal relationship between the intervention and the change in behavior because treatment integrity ratings did not regularly reach an adequate level. DRO has been found to be successful when it is implemented according to specific criteria. One cannot assume that the DRO intervention was responsible for the observed change in behavior if the intervention was not consistently implemented with integrity. Future research may resolve this obstacle through frequent performance feedback.

### References

- Conyers, C., Miltenberger, R., Maki, A., Barenz, R., Jurgens, M., Sailer, A., Haugen, M., & Kopp, B. (2004). A comparison of response cost and differential reinforcement of other behavior to reduce disruptive behavior in a preschool classroom. *Journal of Applied Behavior Analysis*, 37, 411-415.
- Conyers, C., Miltenberger, R., Romaniuk, C., Kopp, B., & Himle, M. (2003). Evaluation of DRO schedules to reduce disruptive behavior in a preschool classroom. *Child & Family Behavior Therapy*, 25, 1-6.
- de Zubicaray, G., & Clair, A. (1998). An evaluation of differential reinforcement of other behavior, differential reinforcement of incompatible behavior, and restitution for the management of aggressive behaviors. *Behavioral Interventions*, 13, 157-168.
- Eyberg, S., & Pincus, D. (1999). *Eyberg Child Behavior Inventory and Sutter Eyberg Student Behavior Inventory-Revised Professional Manual*. Odessa, FL: Psychological Assessment Resources.
- Homer, A. L., & Peterson, L. (1980). Differential reinforcement of other behavior: A preferred response elimination procedure. *Behavior Therapy*, 11, 449-471.
- Kazdin, A. E. (1977). Artifact, bias, and complexity: The ABCs of reliability. *Journal of Applied Behavior Analysis*, 10, 141-150.

- Repp, A. C., Barton, L. E., & Brulle, A. R. (1983). A comparison of two procedures for programming the differential reinforcement of other behaviors. *Journal of Applied Behavior Analysis*, 16, 435-445.
- Repp, A. C., Dietz, S. M., & Dietz, D. E. D. (1976). Reducing inappropriate behaviors in classrooms and in individual sessions through DRO schedules of reinforcement. *Mental Retardation*, 14, 11-15.
- Von Brock, M., & Elliott, S. N. (1987). Influence and treatment effectiveness information on the acceptability of classroom interventions. *Journal of School Psychology*, 25, 131-144.

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*Author's Note*

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